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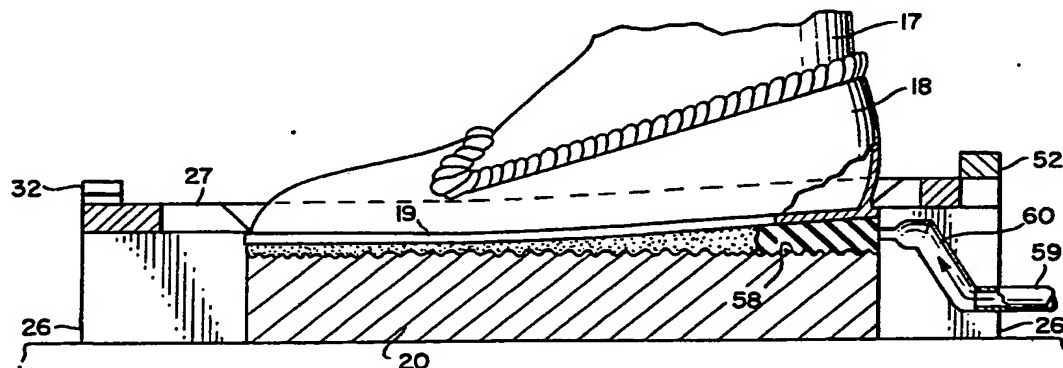
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**(54) Title:** APPARATUS AND METHOD FOR MAKING FOOTWEAR



**(57) Abstract**

A mold (12) for forming a sole on a shoe upper having an extended edge or welt formed about a lower periphery thereof including a sole plate, (20) a last on which the shoe upper (18) may be fitted for forming the sole thereon, positionable in spaced relation to the sole plate, first and second mold sections (21, 22) movable into and out of cooperative relation with the sole plate (20) and the last, the mold sections (21, 22) having recessed portions cooperable with at least the sole plate (20), each other and a portion of a shoe upper (18) and the extended edge thereof, fitted on the last, when the mold sections (21, 22) are positioned in cooperative relation with the sole plate (20) and the last to define a mold cavity (58) having a configuration conforming to a desired configuration of the sole to be molded onto the extended edge and the shoe upper (18) fitted on the last, each of the mold sections having a mechanism movable into and out of clamping engagement with a portion of the extended edge of the shoe upper (18) fitted on the last, a mechanism for moving the extended edge clamping mechanism of the mold sections (21, 22) into engagement with the extended edge when the mold sections (21, 22) are moved into cooperative relation with the sole plate (20) and the last, and at least one of the mold sections (21, 22) having at least one fluid passageway (59) communicable with a fluid molding material source for supplying such material to the mold cavity (58).

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## APPARATUS AND METHOD FOR MAKING FOOTWEAR

Background of the Invention

This invention relates to the manufacture of footwear and more particularly to an apparatus and method for forming a sole on a shoe upper. The invention further contemplates a novel mold for molding a sole on a shoe upper having a welt or an extended edge formed about a lower periphery thereof, fitted on a last.

In the manufacture of certain casual, recreational, or other footwear, it has been the conventional practice in the industry to form a shoe upper from a suitable material, to fit the upper on a last and then to position the bottom surface of the upper fitted on the last in a mold to mold the sole portion of the footwear onto the bottom surface of the upper. In the use of such method, it has been found that the liquid, plastic, or rubber material injected into the mold cavity to form the sole of the footwear inevitably tends to seep between the mold body and the bottom portion of the shoe upper fitted on the last, and set. Such seepage is undesirable in that it requires an additional trimming or cleaning operation which increases the cost of production of the footwear or, if not removed, detracts from the appearance of the final product. It thus has been found to be desirable to provide a means for molding a sole onto a shoe upper fitted on a last which eliminates the problem of seepage heretofore encountered in the use of prior art methods of molding soles on shoe uppers.

Accordingly, the principal object of the present invention is to provide a novel apparatus and method for making footwear.

Another object of the present invention is to provide a novel apparatus and method for forming the sole portion of a shoe on a shoe upper.

A further object of the present invention is to provide a novel apparatus and method for molding the sole portion of a shoe onto a shoe upper.

A still further object of the present invention is to provide a novel apparatus and method of forming the sole portion of a shoe on a shoe upper without incurring any undesirable deposit of sole material on the shoe upper which would require an additional cleaning or trimming operation.

Another object of the present invention is to provide a novel apparatus and method for molding the sole portion on a shoe upper which prevents seepage of the material injected into the mold cavity for the sole, between the mold body and the shoe upper which would deposit and set on or adjacent the shoe upper, requiring an additional trimming or cleaning operation.

A further object of the present invention is to provide a novel apparatus and method for forming the sole portion of a shoe on a shoe upper which are simple in design and operation, comparatively easy to use and relatively inexpensive to construct and perform.



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Other objects and advantages of the present invention will become more apparent to those persons having ordinary skill in the art to which the present invention pertains from the following description taken in conjunction with the accompanying drawings.



Brief Description of the Drawings

Figure 1 is a side-elevational view of an embodiment of the invention, having portions thereof broken away.

Figure 2 is an enlarged, perspective view of several components of the mold assembly comprising a part of the embodiment shown in Figure 1.

Figure 3 is an enlarged, front-elevational view of the embodiment shown in Figure 1, having portions thereof broken away.

Figure 4 is an enlarged, cross-sectional view taken along line 4-4 in Figure 1.

Figure 5 is a view similar to the view shown in Figure 3, illustrating certain sections of the mold assembly in spaced relation.

Figure 6 is an enlarged, cross-sectional view taken along line 6-6 in Figure 1.

Figure 7 is a cross-sectional view taken along line 7-7 in Figure 6.

Figure 8 is a view similar to the view shown in Figure 6, having the last and shoe upper fitted thereon removed and certain mold sections disposed in spaced relation.



Description of the Preferred Embodiment

The present invention generally includes a frame 10, a last carrier assembly 11 supported on the frame and a mold assembly 12 also supported on the frame. Referring to Figure 1, the shoe carrier assembly includes a horizontally disposed shaft 13 supported on a pair of axially spaced components 14 of the frame, and a carrier 15 having a plurality of radially disposed leg sections 16 rotatable about shaft 13 in substantially a vertical plane. Formed on the free end of each leg section is a last 17 on which a shoe upper 18 may be fitted.

The last carrier assembly is adapted to be indexed either manually or by means of an appropriate drive mechanism between a loading and unloading station A, a work station B and cooling or setting stations C and D. It will be appreciated that in a normal operating cycle, a shoe upper may be fitted onto the last positioned at station A, the last carrier may then be indexed to position the last with the upper fitted thereon at the work station B, and then, after forming the sole portion, the last with the upper having a sole portion molded thereon may be indexed to stations C and D for cooling or setting of the sole material. Finally, the last with the finished shoe fitted thereon may be indexed to station A where the operator would remove the finished shoe, fit another upper on the last and repeat the cycle.

It is contemplated that different last carrier assemblies be used corresponding to different shoe sizes and different moldings. It further is contemplated that the uppers fitted onto the lasts be of any desired style and material. Each of such uppers, however, is provided with a strip or welt or extended edge formed about the periphery of a lower portion thereof onto which the sole portion may be molded, in addition to the bottom surface of the upper.

Mold assembly 12 generally includes a sole plate 20 and a pair of mold sections 21 and 22. Sole plate 20 is positioned at work station B and is adapted to be detachably mounted on frame 10. The sole plate is located at work station B so that when a last of the last carrier assembly is positioned at work station B, as shown in Figure 1, the last will be in vertical, spaced alignment with the sole plate. As best shown in Figure 2, the sole plate is provided with a pair of curved sidewalls 23 and 24 usually, but not necessarily, conforming to the shape of the sole to be formed on an upper fitted on a last positioned at work station B, and an upper surface 25 having a desired pattern intended to be embossed on the bottom of the sole to be formed.

Mold section 21 includes a base plate 26 and a clamp plate 27 hingedly mounted on the base plate. The base plate has a height or thickness greater than the height or thickness of sole plate 20, and an inner mating surface 28 having



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a recessed portion 29. The recessed portion of mating surface 28 is defined by a wall 30 having the same shape as and engageable with sidewall 23 of sole plate 20.

The outer side of base plate 26 is provided with a pair of spaced hinge blocks 31 and 32 in which there are provided a pair of aligned hinge pins for hingedly connecting clamp plate 27 to base plate 26. Also mounted at one end of base plate 26 is a camming block 32 having an inwardly and downwardly facing camming surface 33.

Clamp plate 27 is provided with a mating surface 34 having a recessed portion 35. Such recess is defined by a curved surface 36 which is relieved as at 36a. When clamp plate 27 is in a closed position, i.e., pivoted downwardly and resting on the upper surface of base plate 26, the lower edge of the recessed portion thereof overlies the recessed portion 30 of base plate 26, forming a lip portion which is adapted to engage the upper side of a side portion of a welt formed on a shoe upper fitted on a last positioned at work station B. As such lip portion overlies and engages the welt of an upper, curved wall 36 engages a lower side portion of the upper fitted on the last.

Mating surface 34 of clamp plate 27 further is provided with an inwardly and upwardly facing cam surface 37 disposed at one end thereof and an inwardly and downwardly facing cam surface 38 at the opposite end thereof. Clamp plate 27 is biased in an open position, i.e., pivoted upwardly and away from base plate 26, by means of a coil spring 39 seated in a recess provided in the upper surface of base plate 26, and engaging the underside of the clamp plate.

Mold section 22 is similar in construction to mold section 21, consisting of a base plate 40 comparable to base plate 26 and a clamp plate 41 comparable to clamp plate 27. Base plate 40 is provided with an inner surface 42 comparable to and adapted to be mated with inner surface 28 of base plate 26. Mating surface 42 similarly is provided with a recess corresponding to recess 30 defined by a curved wall 43 having the same configuration and engageable with sidewall 24 of the sole plate. Mounted on the outer side of base plate 40 is a pair of hinge blocks 44 and 45, comparable to hinge blocks 31 and 32, provided with a pair of pins for hingedly connecting clamp plate 41 to base plate 40. As best shown in Figure 8, clamp plate 41 is provided with an inner surface 46 adapted to mate with mating surface 34 of clamp plate 27, having a recessed portion 47. Such recessed portion is defined by a curved surface 48, comparable to curved surface 36 of clamp plate 27, relieved as at 48a. Similar to clamp plate 27, the edge of the recessed portion of clamp plate 41, along surface 48, is adapted to overlie the recessed portion of mating surface 42 of base plate 40, and engage the upper surface of a welt formed on a shoe upper fitted on a last disposed at work station B when mold section 22 is in a closed or operative position. Under such conditions, edgewall 48 defining recess 47 will engage a lower side portion of the upper fitted on such last.



Mating surface 46 of clamp plate 41 further is provided with an inwardly and downwardly facing cam surface 49 engageable with cam surface 37 of clamp plate 27, and an inwardly and upwardly facing cam surface 50 engageable with inwardly and downwardly facing cam surface 38 on clamp plate 27.

Base plate 40 also is provided with a coil spring 51 seated in a recess provided on the upper surface of the base plate, and engaging clamp plate 41. In addition, base plate 40 is provided with a clamp block 52 having a downwardly and inwardly facing cam surface 53 adapted to engage an upper corner 54 of cam plate 27 to pivot the clamp plates downwardly against the biasing action of coil springs 38 and 51. Cam surface 33 of cam block 32 similarly is adapted to engage an upper corner 55 of clamp plate 41 to similarly urge the two clamp plates downwardly against the biasing action of coil springs 39 and 51.

Mold sections 21 and 22 are disposed at work station B and are caused to move inwardly and outwardly into and out of engagement with sole plate 23 by means of a pair of conventional hydraulic cylinder assemblies 56 and 57, or other equivalent means. Such assemblies may be operated independently of the indexing of the last carrier assembly or may be operated in synchronization with the indexing of the last carrier assembly to provide a more automated operation.

In the use of the apparatus as described, the hydraulic cylinder assemblies are operated to supply fluid under pressure to the rod sides of the cylinders, causing the rods to retract and the mold sections to be spaced apart as shown in Figures 5 and 8. With the mold sections thus positioned, a shoe upper having a welt 19 formed thereon is fitted on a last positioned at loading and unloading station A. As soon as the upper is suitably fitted on the last, the last carrier assembly is indexed to position the last with the upper at work station B whereby the last will be disposed in spaced, vertical alignment with sole plate 20. With the last thus positioned, the control circuit for the hydraulic cylinder assemblies is activated either manually or automatically to cause fluid under pressure to be supplied to the piston ends of the cylinder assemblies to extend the rods thereof and thus cause mold sections 21 and 22 to move together into engagement with the sole plate and the peripheral side edge of welt 19.

As the mold sections thus come together, base plate mating surfaces 28 and 42 engage and recess surfaces 30 and 43 of the base plates engage sidewalls 23 and 24 of the sole plate. In addition, as the mold sections are moved together into engagement with the sole plate, initially, cam surfaces 33 and 53 engage corner surfaces 55 and 54, respectively, and, sequentially, cam surface 37 engages cam surface 49 and cam surface 38 engages cam surface 50, to cause clamp





plates 27 and 41 to pivot downwardly against the biasing action of springs 39 and 51 to engage the upper peripheral portion of welt 19, as best shown in Figures 4, 6 and 7. The interrelationship of a last and the mold assembly as described, provides a mold cavity 58 defined by upper surface 25 of the sole plate, the bottom surfaces of the upper fitted on the last and the welt formed on such upper, and the upper portions of recess sidewalls 30 and 43.

With the mold cavity thus formed, a fluid sole forming material is supplied through suitable supply line 59 connected to suitable fluid passageway 60 provided in the base plates of the mold sections, and injected into mold cavity 58 in the conventional manner. Air is ejected from the mold cavity as the sole forming material is injected therein.

As soon as the mold cavity has been filled and the material has been allowed a short time to set, the controls for the hydraulic cylinder assemblies are operated to retract the mold sections, permitting the clamp plates thereof to be released and biased upwardly out of engagement with the upper sides of the welt or extended edge. Sequentially, the sole plate may be lowered to free the molded sole therefrom and the last carrier assembly is indexed to position the shoe with the newly formed sole to cooling or setting station C while another last having an upper fitted thereon is positioned at the work station to begin another molding operation. Eventually, the finished shoe is cycled back to loading and unloading station A where it is removed by the operator. The operator then fits another upper on the last to continue the operation.

The shape of the bottom portion of the shoe upper fitted on a last at the work station and the welt formed thereon, conforms to the shape of the upper surface of the sole plate so that when the mold assembly is in an assembled condition as shown in Figure 4, recess walls 30 and 43 of base plates 26 and 40 will engage the side edges of the welt and clamp plates 27 and 41 will engage the upper edges of the welt or extended edge. Under such conditions, the molding material injected under pressure into mold cavity 58 will be prevented from seeping between the welt or extended edge and either a base plate or a clamp plate. Accordingly, no molding material will be deposited either on the side or upper edges of the welt or extended edge requiring an additional cleaning or trimming operation.

As the mold sections move apart and the various interengaging cam surfaces disengage, the biasing action of coil springs 39 and 51 will cause the clamp plates to disengage the welt on the shoe upper thus facilitating the retraction of the mold sections and posturing the clamp plates for the positioning and clamping of the next shoe upper.

By varying the last sizes, the materials and styles of the shoe uppers and the sizes and configurations of the mold components, different footwear of various



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styles and different sizes can be manufactured with the present invention.

Although a rotary type of last carrier assembly has been described in connection with the present invention, it is contemplated that other types of devices may be used to position and remove lasts having shoe uppers fitted thereon with respect to the mold assembly as described, for forming the sole portion of a shoe on a shoe upper. In addition, it is within the contemplation of the invention to utilize any moldable materials for forming the sole portions, including conventional thermoplastics and vulcanized rubber.

From the foregoing detailed description, it will be evident that there are a number of changes, adaptations and modifications of the present invention which fall within the province of those persons having ordinary skill in the art to which the present invention pertains. However, it is intended that all such variations not departing from the spirit of the invention be considered as within the scope thereof as limited solely by the appended claims.



The Claims

1. An apparatus for forming a sole on a shoe upper having an extended edge formed about a lower periphery thereof comprising a sole plate disposed at a work station, at least one last on which said shoe upper may be fitted for forming said sole thereon, means for positioning said last with a shoe upper fitted thereon at said work station with said last being spaced from said sole plate, sole molding means disposed adjacent said work station, said molding means including first and second sections movable into and out of cooperative relation with said sole plate and a last positioned at said work station, said mold sections having recessed portions cooperable with at least said sole plate, each other and a portion of a shoe upper and the extended edge thereof, fitted on a last positioned at said work station, when said molding sections are positioned in their cooperative relation with said sole plate and a last positioned at said work station, to define a mold cavity having a configuration conforming to a desired configuration of the sole to be molded onto the extended edge and shoe upper fitted on said last positioned at said work station, means for moving said first and second mold sections into and out of said cooperative relation with said sole plate and a last positioned at said work station, each of said mold sections having means movable into and out of clamping engagement with a portion of the extended edge of a shoe upper fitted on a last positioned at said work station, means for moving the extended edge clamping means of said mold section into engagement with an extended edge of a shoe upper fitted on a last positioned at said work station when said mold sections are moved into said cooperative relation with said sole plate and a last positioned at said work station, and means for injecting a sole forming material into said mold cavity.

2. The apparatus according to Claim 1 wherein said means for moving the extended edge clamping means comprise means disposed on said mold sections.

3. The apparatus according to Claim 2 wherein said means for moving the extended edge clamping means comprise interengaging cam surfaces.

4. The apparatus according to Claim 3 wherein said extended edge clamping means normally are biased in a nonengaging relation relative to said extended edge.

5. The apparatus according to Claim 1 wherein said extended edge clamping means comprises a plate member pivotally mounted on a mold section.

6. The apparatus according to Claim 5 wherein said means for moving said extended edge clamping means comprise cam surfaces disposed on said mold sections and said plate members interengageable when said mold sections are moved into said cooperative relation to pivot said plate members onto outer sides of said extended edge.



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7. The apparatus according to Claim 6 wherein said plate members normally are biased in a nonengaging relation relative to said extended edge.

8. The apparatus according to Claim 1 wherein recessed portions of said mold sections engage the periphery of said extended edge when in said cooperative relation with said sole plate and a last positioned at said work station.

9. A mold for forming a sole on a shoe upper having an extended edge formed about a lower periphery thereof comprising a sole plate, a last on which said shoe upper may be fitted for forming said sole thereon, positionable in spaced relation to said sole plate, first and second mold sections movable into and out of cooperative relation with said sole plate and said last, said mold sections having recessed portions cooperable with at least said sole plate, each other and a portion of a shoe upper and the extended edge thereof, fitted on said last, when said mold sections are positioned in cooperative relation with said sole plate and said last, to define a mold cavity having a configuration conforming to a desired configuration of the sole to be molded onto the extended edge and shoe upper fitted on said last, each of said mold sections having means movable into and out of clamping engagement with a portion of the extended edge of the shoe upper fitted on said last, means for moving the extended edge clamping means of said mold section into engagement with said extended edge when said mold sections are moved into said cooperative relation with said sole plate and said last, and at least one of said mold sections having at least one fluid passageway communicable with a fluid molding material source for supplying said material to said mold cavity.

10. The mold according to Claim 9 wherein said means for moving the extended edge clamping means comprise means disposed on said mold sections.

11. The mold according to Claim 10 wherein said means for moving the extended edge comprises interengaging cam surfaces.

12. The mold according to Claim 11 wherein said extended edge clamping means normally are biased in a nonengaging relation relative to said extended edge.

13. The mold according to Claim 9 wherein said extended edge engaging means comprises a plate member pivotally mounted on a mold section.

14. The mold according to Claim 13 wherein said means for moving said extended edge clamping means comprise cam surfaces disposed on said mold sections and plate members interengageable when said mold sections are moved into said cooperative relation with said sole plate and said last to pivot said plate members onto outer sides of said extended edge.

15. The mold according to Claim 14 wherein said plate members normally are biased in a nonengaging relation relative to said extended edge.

16. The mold according to Claim 9 wherein recessed portions of said mold sections engage the periphery of said extended edge when disposed in said

cooperative relation with said sole plate and said last.

17. A method of forming a sole on a shoe upper having an extended edge along a lower periphery thereof comprising fitting said upper on a last, positioning the last with the shoe upper fitted thereon in spaced relation to a sole plate, positioning mold sections having recesses therein in cooperative relation with said last and sole plate forming a mold cavity defined by said sole plate, recessed portions of said mold sections a portion of said shoe upper fitted on said last and said extended edge, positioning at least one plate on the outer side of said extended edge to provide a backing for said extended edge and seal the spaces between said extended edge and said mold sections, injecting a molding material into said mold cavity, permitting said mold material to set and then removing said backing plates and mold sections.



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FIG. 1.

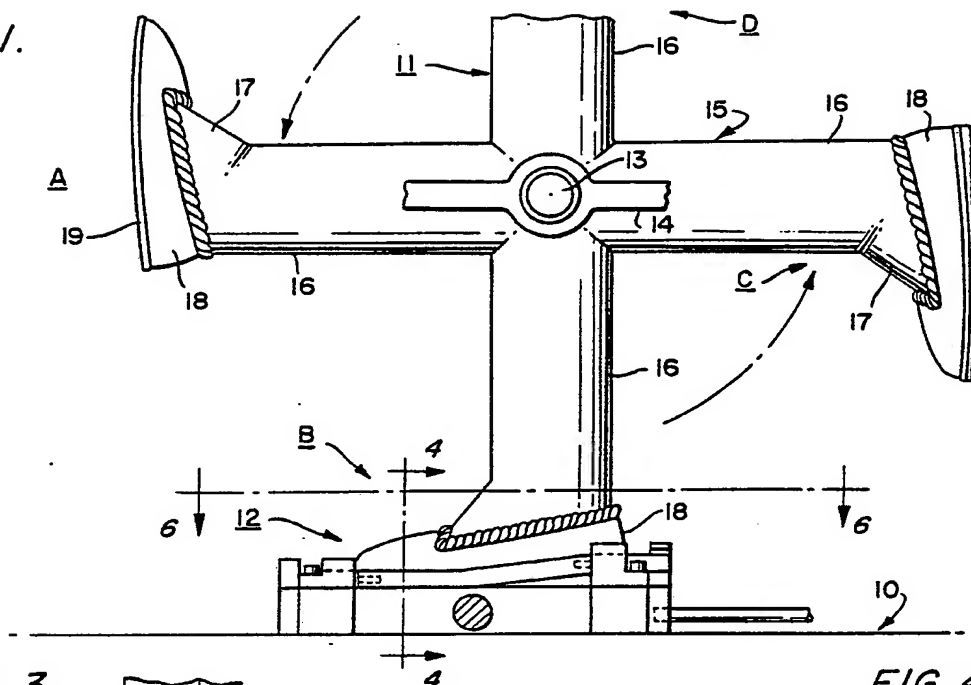


FIG. 3.

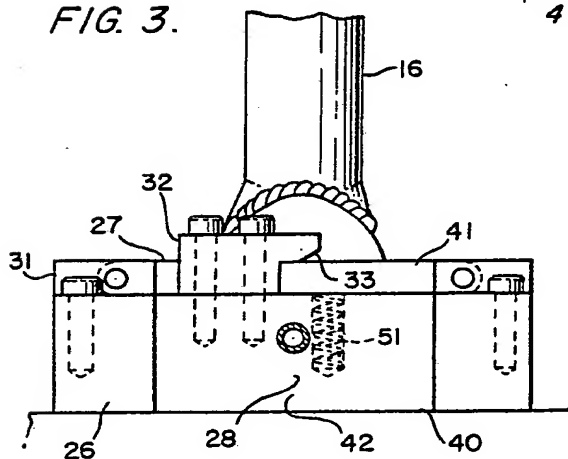


FIG. 4.

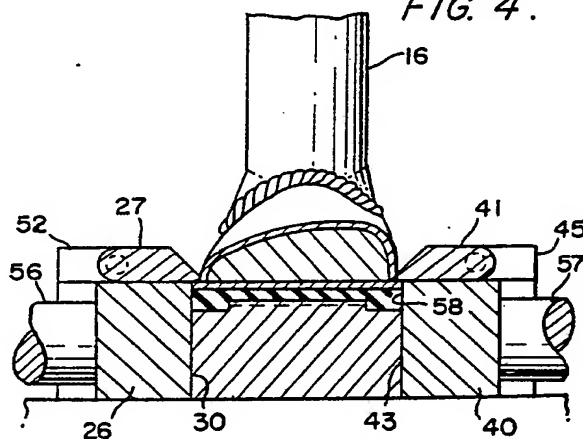
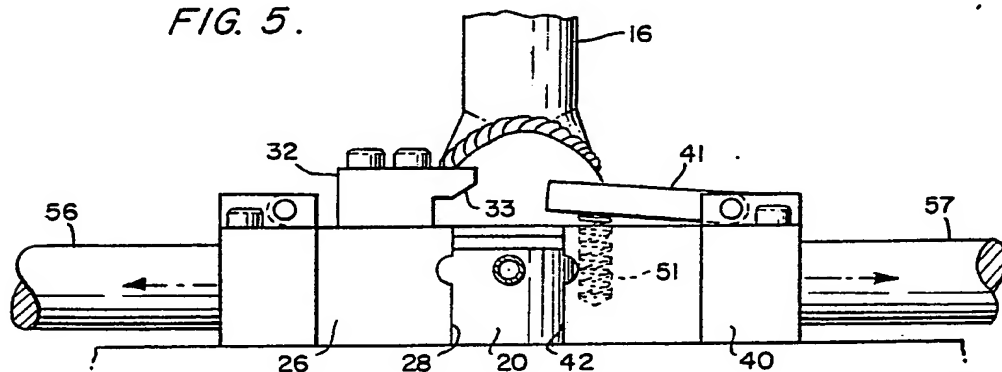
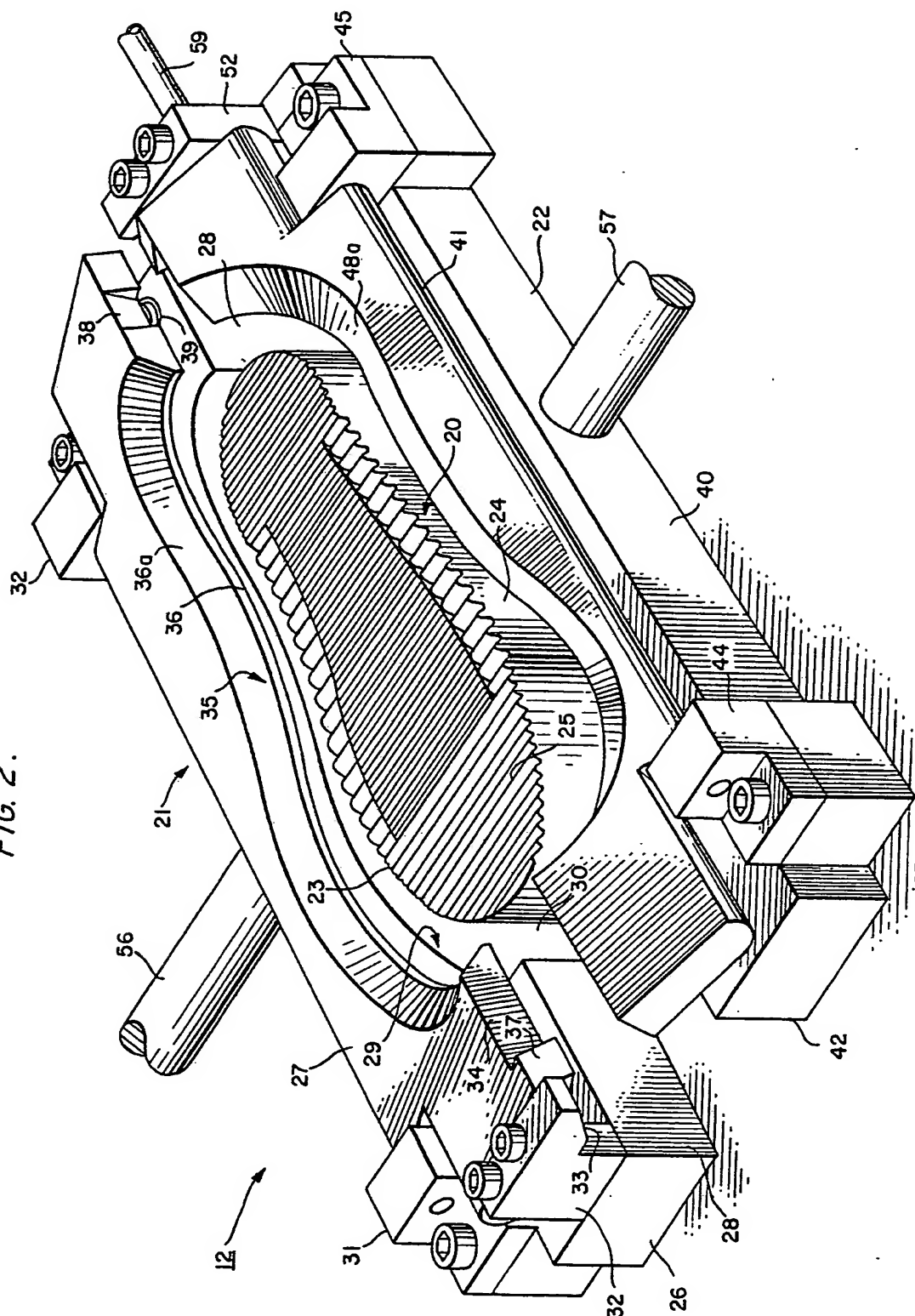


FIG. 5.



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FIG. 2.



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FIG. 6.

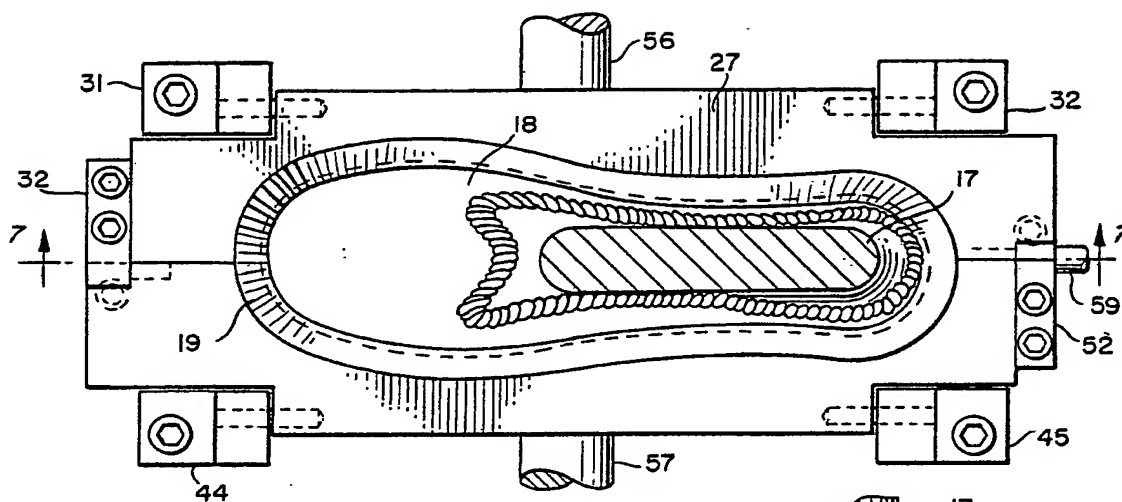


FIG. 7.

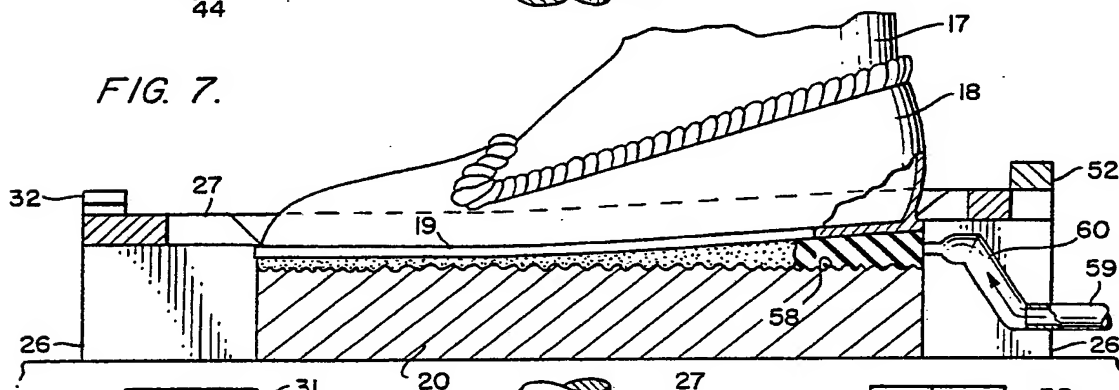
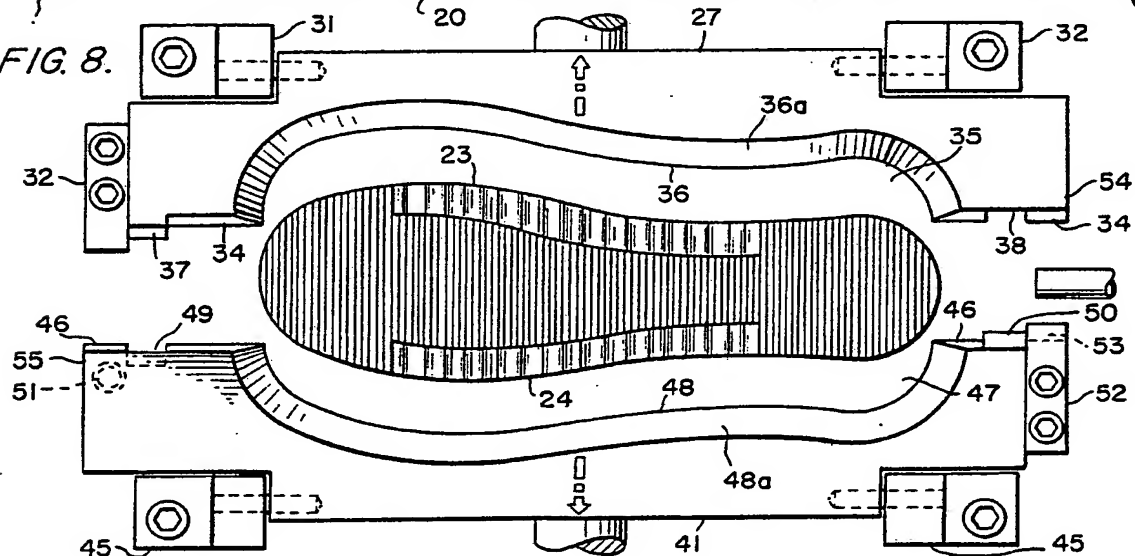


FIG. 8.





# INTERNATIONAL SEARCH REPORT

International Application No PCT/US 84/00705

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
INT. CL. <sup>3</sup> A43D 65/00		
US. CL. 425/129S 264/244 12/142T		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
U.S.	12/142T, 17R 425/119, 129S 264/244	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>6</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
A	US, A 4,217,081 (Rooney) 12 August 1980	
A	US, A 4,032,611 (Fukuoka) 28 June 1977	
A	US, A 3,949,040 (Drab) 06 April 1976	
A	US, A 3,671,621 (Fukuoka) 20 June 1972	
Y	US, A 3,669,590 (Nova et al) 13 June 1972	2-7, 10-15
X	DT, A 2,830,605 (Desma-Werke) 31 January 1980	1-17
<p><sup>15</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>19</sup>	Date of Mailing of this International Search Report <sup>20</sup>	
12 June 1984	06 JUL 1984	
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>20</sup>	
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